Amendments to the Specification:

The following amendments to the Specification are exhibited in bold-italicized characters for ease of identification. They are not intended to appear as such in the amended document.

- Please add the qualifying descriptors, including both transmitter and reflector, to the second sentence in paragraph [0003]:

[0003] When a compression mode impulse is superposed on a volume of viscoelastic material, rapid displacement of the material takes place in response to transient compression stress. This invention applies sonic lens, ***including both transmitter and reflector,*** configurations to attain high-power-density; i.e., high-rate of energy transfer within a confined volume of material, by superposing compression and shear impulses.

- Please replace paragraph [0004] with the following:

[0004] Waveguides, impulse transit delay lines, ***resonant elements,*** and sonic impedance ***transformers*** are ***also*** inherent features of the apparatus disclosed herein. ***Said features*** apply basic underlying principles of sonic wave behavior and are not ***unique to*** the description and claims exhibited in the disclosure of this invention.

- Please replace paragraph [0005] with the following:

[0005] ***In this disclosure:*** fusion is cohesive joining of contiguous materials, welding is a process of fusion by dispersion of cohesive inhibiting substances,

*a*dhesion is the bonding of contiguous dissimilar materials by molecular attraction, and *m*aterials forming is a process of deformation and substructure modification.

- Please add the term <u>arc</u> to the second sentence in paragraph [0009]:

[0009] Yet another object of the invention is to provide a wide range of applicability for materials joining with similar and dissimilar metals, and non-metallics. Another object of this invention is absence of thermal hazards and high intensity light flashes common to conventional ***arc*** welding processes. Another object of the invention is to avert residual stress and heat affected zones accompanying conventional thermal welding processes.

- Please replace "configurations" in the second sentence of paragraph [0014] with the qualifying descriptors <u>shape, and resonance inducing features</u> and add the term <u>resonance</u> to the third sentence in paragraph [0014]:

[0014] Said sonic shear wave energy is derived and partitioned from said sonic compression wave impulse through a refraction angle, codependent with inherent sonic wave velocities of said sonic lens and said workpiece. Said sonic lens spatial distribution***, shape, and resonance inducing features*** provide for coincident transit source, or sources, may be modulated to optimize sonic power spectral densities in said workpiece. Materials in said apparatus are selected for inherent sonic velocity, ***resonance***, and impedance attributes to attain required

impulse transmission, reflection, refraction, and mode conversion properties. Sonic waveguides may be applied for impedance matching among said energy sources, said sonic lens, and said workpiece.

- In the fourth sentence of paragraph [0019], please replace the word "numeral" with the letter :

[0019] Figure 3-II illustrates, with arrows, two compression impulse directions within the lens. The numeral 36 shows the direction of a compression impulse aimed into the workpiece at normal incidence. The lens compression impulse numeral 37 is refracted at the internal bi-material lens interface, and thence directed at the lens-to-workpiece interface at an angle that induces refracted shear mode propagation within the workpiece. The high-power-density superposition of shear and compression impulses induces viscoelastic materials behavior. Material displacement is driven by both the external quasi-static downward load, depicted by ***the letter*** Q in figure 3-I, and the compression impulse. The workpiece yields to a relatively low stress in zones where shear and compression modes are superimposed.

- Please add the following paragraph (in bold characters) ***[0020.1]***:

[0020.1]The first embodiment as configured in figure 4-I, depicts a resonant body 42 interposed between the impactor 27 and the workpiece elements 22 and 24. The resonant body is composed of material with a selected sonic wave velocity, mass and shape to both support a standing

wave 42 and transform sonic impedance from the impactor to the workpiece. The schematic depiction in figure 4-II shows the resonant compression standing wave impinging on the workpiece. Further, that fraction of the resonant sonic compression wave 42 transmitted through the workpiece is reflected back by lens 23, at a direction C, to refract and convert to a shear mode S within the workpiece. Resonance is sustained for a time period sufficient to permit temporal and spatial coincidence of sonic compression and shear wave modes within the workpiece.

- Please change the first sentence in paragraph [0021] by replacing figures 1 through 3 with figures 1 through 4 and adding the term fuse, :

[0021] The apparatus and processes described in figures 1 through ***4*** can be applied to ***fuse,*** modify material substructure, promote cohesion, and activate bonding agents for adhesion among workpiece elements, including metallics and nonmetallics.

- Please change the first sentence in paragraph [0022] by replacing "figures 1, 2, and 3" with figures 1, 2, 3, and 4, and particularly the resonator depicted in figure 4, . Please add the words and resonators and resonance to the third sentence in paragraph [0022] :

[0022] The sonic lenses depicted in figures 1, 2, ***3, and 4, and particularly the resonator depicted in figure 4,*** are specific examples of numerous possible configurations designed to induce shear mode impulses, coincident with compression mode impulses, in single or multi-element workpieces. Shear modes are derived from angular incidence of a compression impulses on the interface between: two contiguous dissimilar materials, the sonic lens, and the workpiece with each material exhibiting different inherent velocity of sonic wave propagation. Additionally, the sonic lenses ***and resonators*** are designed to impart phase or amplitude coherence of the shear and compression modes within the zone, or zones of wave mode superposition by selectively establishing impulse transit times from source-to-workpiece, through length of wavepath, ***resonance,*** and inherent shear and compression wave velocities of materials.

- Please add the term resonators to the second sentence in Abstact of Disclosure paragraph [0035]

Abstract of the Disclosure

[0034] This invention comprises an apparatus and method for sonic welding and materials forming by superposition of high-power density sonic shear wave and sonic compression wave impulses directed by a sonic lens into a workpiece. The shear impulse is induced by refraction and mode conversion of a compression

impulse. Materials subjected to shear impulses are transformed from solid-to-viscoelastic state. The compression impulse is superimposed on the shear impulse. Welding is effected by shear induced viscoelasticity, combined with quasi-static and dynamic compressive stress, at interfaces among workpiece elements. Further, superimposed shear and compression impulses are applied to fuse, shape, and transform material.

[0035] The apparatus functions with a range of impulse sources. The shear impulse is mode converted from the compression impulse. Waveguides and ***resonators*** may be applied for impedance matching and energy transfer among the impulse source(s), sonic lenses, and workpiece. The present invention relates to solid state welding, materials forming, fusion, cohesion, adhesion, and substructure modification.

Amendments to the Claims:

The following amendments to the Claims are exhibited in bold-italicized characters for ease of identification. They are not intended to appear as such in the amended document.

The listing of claims will replace all prior versions, and listings, of claims in the application: